OUR BOOKSHELF.

Horses. By Roger Pocock. With an Introduction by Prof. J. Cossor Ewart. Pp. x+252. (London: John Murray, 1917.) Price 5*s.* net.

THIS is an entertaining little volume, written by one who has spent much of his life among horses as a ranchman; and from the ranchman's point of view he surveys horsemanship the world over. As a standard of comparison this is useful enough, but, unfortunately, it has distorted his judgment. Hence he is led to assure us that "the pleasure horse and his equipment are so highly specialised for running and jumping that they have ceased to possess the slightest value for civil and military working horsemanship." Yet, as a matter of fact, a large proportion of British cavalry has been horsed during the present war by animals taken from the hunting-field. The best bred of these animals, indeed, are generally considered to make the finest cavalry chargers in the world. The author has some pertinent criticisms on our saddles and mode of riding, and on our treatment of horses in and out of the stable, which will at least repay careful consideration from those immediately concerned.

Of his own feats in the saddle he has much to say, and some of these indeed savour of the wonderful. They are, at any rate, eminently readable. Less entertaining are his sneers at the "scientist," whom he regards as "an amateurish, unpractical sort of person, who cannot either ride or cook"—these being the only accomplishments for which he has any regard. His confidence in his powers of observation, and his knowledge of the lie of the land, even in unexplored country, are so absolute that he has no use for either the compass or maps!

In a chapter on the origin of the horse—which he owes to the "scientist"—he assures us that "the bald skin of the pig is boldly painted in splashes of pink and brown to imitate the lights and shadows of forest undergrowth. The forest ancestors of the horse were bald and painted in the same way. . . ." Pink pigs may be seen in our farmyards in plenty, but we know of no wild race similarly coloured, and there is no reason for supposing that the forest ancestors of the horse were "bald."

If the author had adopted a less superior attitude his book would have been even more readable than it is.

Bacon's New Series of Physical Wall Atlases: British Isles. Scale 1:1,187,000 (18·7 miles to an inch). (London: G. W. Bacon and Co., Ltd.) Price 26*s.*

THE seven maps in this series vary a great deal in value. The orographical map, with layers in two colours and showing also trunk railways and Roman roads, the geological map, and the rainfall map are all clear and useful. The isotherm map would be improved by the omission of the mean annual isotherm, which is not only confusing when on the same map as the January and July ones, but of little or no value in geographical teaching. The map showing vegetation and productions is not a success. The large letters to indicate the location of various industries are crowded and somewhat arbitrarily selected. Thus Aberdeen is given no granite industry, while Ballater is; Leeds has no indication of its leather factories, or Elgin of its distilling and brewing. The West Riding coalfield extends much further east than shown. In the population map the many colours employed give a bad impression and make a confused map. The last map, that of communications, might well have been omitted. It shows some of the lines of the various railway companies all differentiated from one another. There seems to be little object in teaching the ownership of each line, but the great objection to the map is the want of any indication of relief. Without this there is no sense in teaching lines of communication. Moreover, the orographical map does all that is required in this matter.

All the maps have the same names printed in ground colour for the use of the teachers. It is useful to have the series all on the same scale, but we are at a loss to understand why this particular scale should have been selected. It does not facilitate comparison with maps on other scales.

Météorologie du Brésil. By C. M. Delgado de Carvalho. Pp. xix+527. (London: John Bale, Sons, and Danielsson, Ltd., 1917.) Price 25*s.* net.

THE publication of this work is very welcome, not only to meteorologists, but also to those having interests in this progressive Republic. Few except those who have had occasion to deal with South American meteorological observations can appreciate the onerous nature of the task which the author set himself in the preparation of this comprehensive climatology of his native country. In most cases the difficulties have been successfully surmounted, with the result that we have put before us in a very readable and instructive form a series of pictures showing not only the diverse character of the climates of Brazil, but also the interconnection that exists between climatic conditions and migration, immigration, and public health. The work opens with a summary of the broad climatic features, and of the local and general conditions affecting them. An interesting section deals with the "action centres" of the atmosphere, and of the genesis of the tropical rains. Nearly two-thirds of the book are devoted to an analysis of climatological data, this section including no fewer than thirty-four separate studies of local climate, the stations selected ranging from Para, near the equator, to Pelotus, in lat. 32° S. In some areas, such as the State of San Paulo, where stations are numerous, much additional information is given, especially regarding the diurnal range of the climatic elements. The unique position which Brazil occupies for a study of various meteoro-

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logical problems of the first importance is pointed out by Sir Napier Shaw in the preface, and we trust that the wished-for extension of stations into wide areas not yet represented in the *Réseau Mondial* will materialise before long.

The work concludes with an excellent bibliography of the 160 memoirs consulted by the author. There are numerous illustrations, including plates showing the seasonal isotherms, and isopleths for four typical stations. This book will remain a standard work of reference on Brazilian meteorology for many years to come. R. C. M.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* Nature. *No notice is taken of anonymous communications.*]

The Radiation of the Stars.

The law $T \propto M^{\frac{1}{12}}\rho^{\frac{1}{6}}$ given by Prof. Eddington in Nature of June 14 is so neat that one feels reluctance to cast any doubt on it, but since it is notoriously difficult to destroy a scientific error which has once obtained a fair start, I feel that whatever is to be said against the law ought to be said now.

The law is derived from Prof. Eddington's supposed equation, radiation-pressure = gravity. It must first be noticed that the two sides of this equation are of different physical dimensions ($ML^{-1}T^{-2}$ and LT^{-2} respectively), so that neither the arguments on which the equation is based nor the laws derived from it can carry much conviction. If p_G and p_R denote gas-pressure and radiation-pressure, the true equation of equilibrium is

$$\frac{\partial}{\partial r}(p_G+p_R) = -\rho g,$$

g being gravity, and when p_G is neglected in comparison with p_R, g does not become equal to p_R, but to $-\frac{1}{\rho}\frac{\partial p_R}{\partial r}$.

It is true that in his original paper on this subject (*M.N.*, November, 1916) Prof. Eddington obtains a relation of the form $p_R = Rg$, where R is a constant, but this equation is not based on the physical conceptions put forward in the article in Nature. The outward flow of radiation from a star of radius r and effective temperature T is, of course, $4\pi r^2 \times \sigma T^4$. Where does the energy of this radiation come from? Prof. Eddington assumes that it is a transformation of radio-active energy, initially emitted at a uniform rate $4\pi\epsilon$ per unit mass throughout the whole star. The star is assumed to be in a steady state, so that the rate of generation of energy, $4\pi M\epsilon$, is equal to the rate of emission $4\pi r^2\sigma T^4$, whence $\sigma T^4 = M\epsilon/r^2$.

This equation is of the form $p_R = Rg$, and on eliminating r by means of the relation $M = \frac{4}{3}\pi\rho r^3$, we find that $T \propto M^{\frac{1}{12}}\rho^{\frac{1}{6}}$. (Prof. Eddington's complicated analysis, boiled down to its essentials, comes merely to this.) But it now appears that the supposed law is not, as might be thought from a casual reading of the article in Nature, a deduction from already known laws of Nature; it is a transformation of the very special assumptions that all stellar matter is equally and uniformly radio-active, and that this radio-activity is the origin of all the energy radiated from a star.

The second supposed law, that the total emission of radiation from a star depends only on its mass, is a still more thinly veiled repetition of the same assumptions. The radiation is *assumed* to be $4\pi M\epsilon$, and ϵ is assumed to be a universal constant. When these assumptions have been made, it is scarcely worth announcing as a new law that the radiation depends only on M.

I venture to think that few physicists will be ready to accept these assumptions; in any case it is important that they should be clearly stated. It may be remarked that if the assumptions are true for giant stars they might be expected to be equally true for dwarf; they lead, however, to the laws given by Prof. Eddington, such as that of absolute brightness depending only on mass, which are palpably untrue for dwarf stars. J. H. Jeans.

London, June 16.

Mr. Jeans's criticism of the dimensions of my equation, "radiation-pressure = gravity," is clearly only a verbal matter. It may be preferable to expand the sentence so as to read, "force on material due to radiation-pressure = force on material due to gravity." But statements that radiation-pressure is x times gravity have been commonly made in connection with the theory of the repulsion of comets' tails, and I thought the reader would have no difficulty in interpreting my statement in the same sense.

The rest of Mr. Jeans's letter is based on a misconception. He states that I assume ϵ (the rate of liberation of energy per unit mass) to be a universal constant; that is not the case, and consequently his account of the mode in which my principal results arise is erroneous. My results are not "a transformation of the very special assumptions that all stellar matter is equally and uniformly radio-active. . . ."

I should be glad to take the opportunity of correcting a misprint in the article: p. 309, col. 2, l. 18 from bottom, *for* $M\rho^{\frac{2}{3}}$ *read* $M^{\frac{1}{3}}\rho^{\frac{2}{3}}$. A. S. Eddington.

Cambridge, June 19.

Protection from Glare.

Efficient protection of the eyes from glare is a subject of considerable importance at the present time, but unfortunately a great deal of misconception has arisen in regard to it. Most glare protectors are designed for conditions of unusually strong illumination; generally speaking, for daylight. Many industrial operations also demand the use of light filters. We will deal first with the problem of protection in sunlight.

A great deal of experimental work has been done recently on the physiological effects of ultra-violet radiation in the eye, a quartz-mercury lamp being used as a source, which is especially rich in its emission of the shorter wave-lengths. The results, unquestionable and undoubted, are that with long-continued exposure serious harm may result from the absorption of these shorter waves by the refracting media of the eye, but with low intensities of radiation regular exposures produce no permanent effect. Turning now to the effects of daylight on the eyes, we recognise that few cases occur in which the symptoms point directly to the influence of ultra-violet light as distinct from the effects of ordinary strong illumination; but the problem of nerve strain arising from glare is ever present.

Quite low intensities of light will produce glare

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